

U. WEDGE.
METALLURGICAL FURNACE.
APPLICATION FILED SEPT. 11, 1912.

1,133,828.

Patented Mar. 30, 1915.

4 SHEETS—SHEET 1.

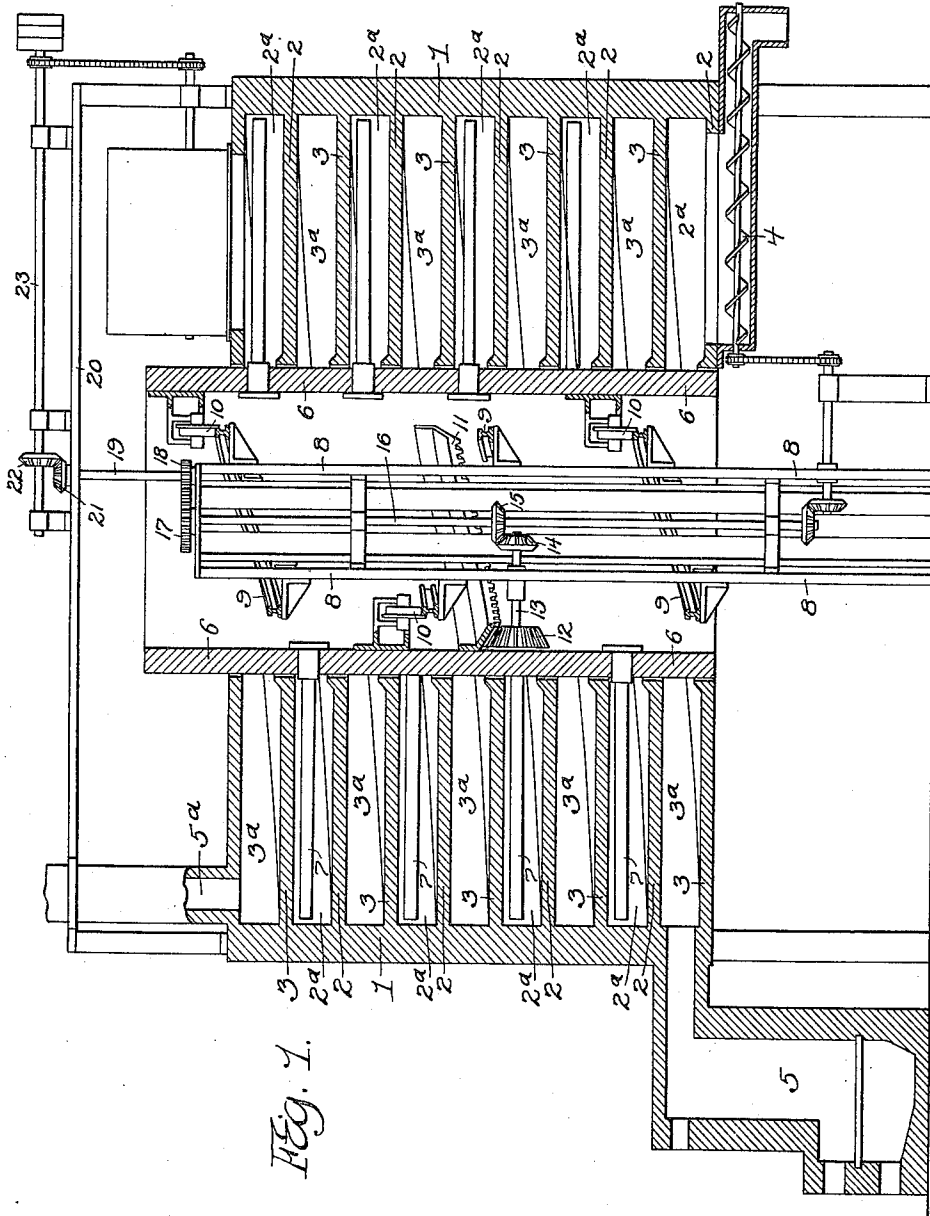


Fig. 1.

WITNESSES

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4 SHEETS-SHEET 2.

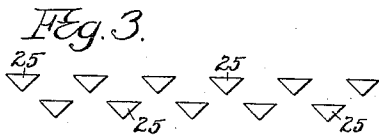
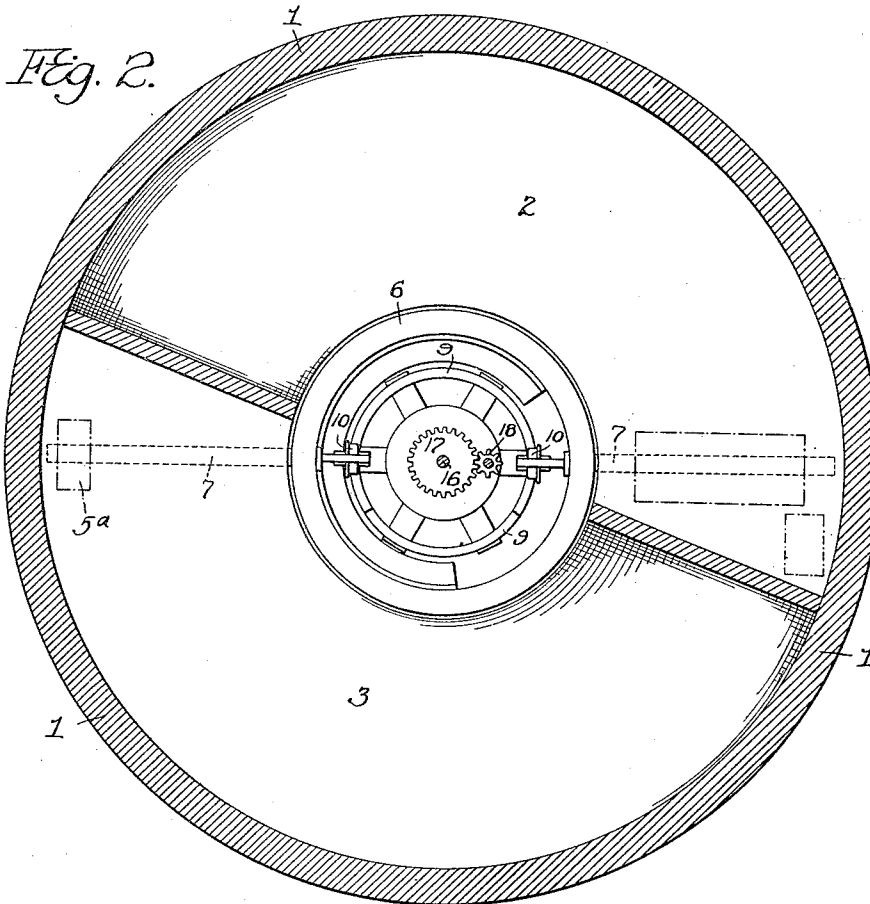


Fig. 5.

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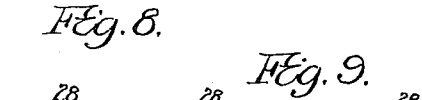
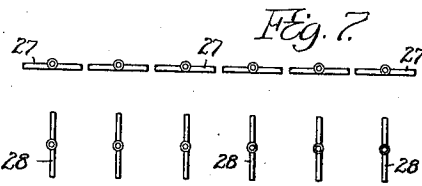
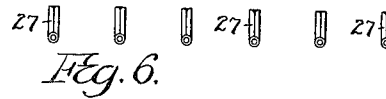


Fig. 9.

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4 SHEETS-SHEET 3.

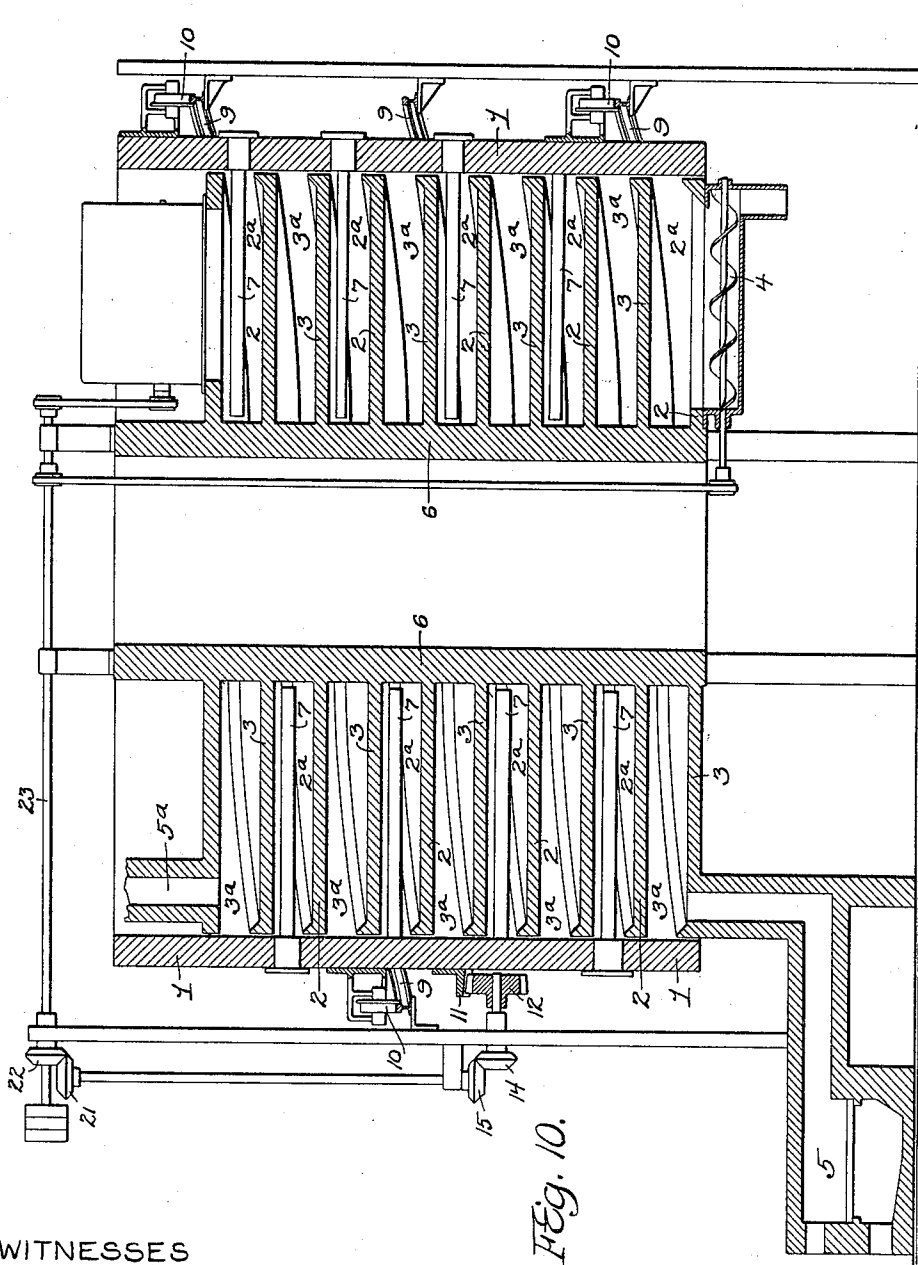


Fig. 10.

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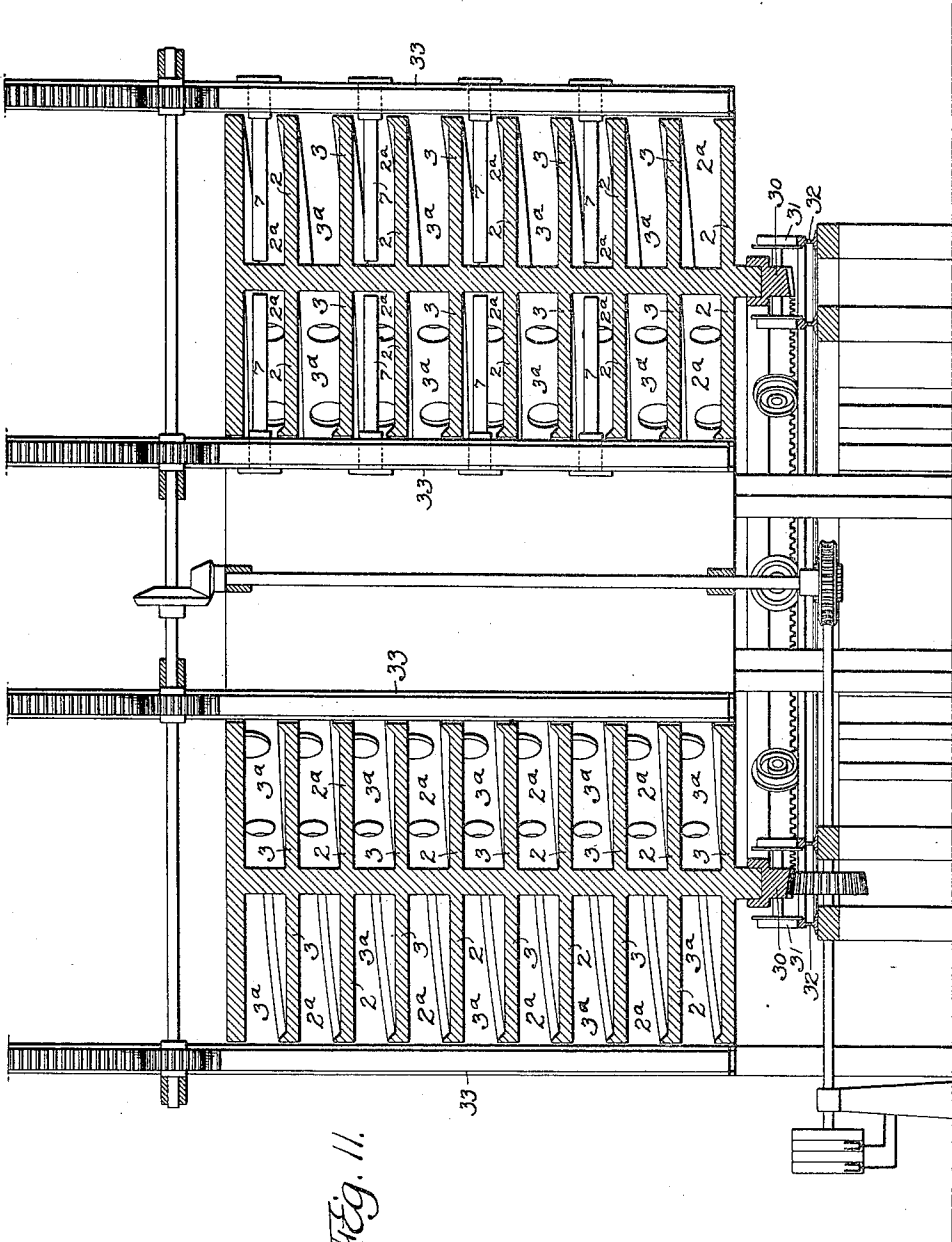
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4 SHEETS—SHEET 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

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METALLURGICAL FURNACE.

1,133,828.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, UTLEY WEDGE, a citizen of the United States, residing in Ardmore, Pennsylvania, have invented certain
5 Improvements in Metallurgical Furnaces, of which the following is a specification.

My invention consists of certain improvements in helical or spiral hearth furnaces for roasting or otherwise treating material
10 such as powdered or granular ore, or the like (hereinafter, for convenience, referred to as "ore") one object of my invention being to construct a furnace of this type which shall be relatively limited in height
15 but will have extended hearth area combined with a relatively quick travel of the ore through the furnace, another object being to provide a simple and efficient form of muffle furnace of this type, and a still
20 further object being to provide simple and effective means for operating the rabble arms with which the furnace is provided. These objects I attain in the manner hereinafter set forth, reference being had to the
25 accompanying drawings, in which—

Figure 1 is a view, partly in elevation and partly in transverse vertical section, of a helical furnace of the muffle type constructed in accordance with my invention; Fig. 2 is a plan or top view of the same with the roof and superstructure removed; Figs. 3 to 9, inclusive, are views showing different types of rabbles which may be used; Fig. 10 is a view similar to Fig. 1 but illustrating a modification in the structure of the furnace, and Fig. 11 is a view similar to Fig. 1 illustrating a furnace having a rotatable hearth structure.

Referring in the first instance to Figs. 1 and 2, 1 represents the circular outer wall of the furnace mounted upon legs or other suitable supporting structure at its lower end and carrying a pair of inwardly projecting helices 2 and 3, the helix 2 constituting the hearth or floor of a chamber 2^a which receives the ore to be treated and the roof of a chamber 3^a which receives the products of combustion from a suitably located fireplace, and the helix 3 constituting the floor of the chamber 3^a and the roof of the chamber 2^a. The convolutions of the chamber 3^a alternate with those of the chamber 2^a throughout the height of the furnace and the passage of the products of
55 combustion through said chamber 3^a serve

to heat the contents of the treating chamber 2^a, the furnace being one of the muffle type, the gases evolved from the material on the hearth 2 having no access to the chamber 3^a and the heating gases flowing through
60 the chamber 3^a having no access to the chamber 2^a. The heating gases may flow freely through the chamber 3^a or such flow may be more or less obstructed by means of checkerwork, baffle walls, or the like, according to the effect desired.

The material to be treated is fed to the upper portion of the hearth 2 by means of any available form of feeding device providing, by preference, for the uniform flow
70 of material onto the hearth, and said material proceeds progressively downward along the hearth until it reaches the point of discharge from whence it may be carried by any desirable form of conveyor 4 to
75 a suitably located point of deposit.

In the present instance, the products of combustion are derived from a fireplace 5 at one side of the furnace and ascend through the chamber 3^a from the bottom to
80 the top of the same from which they may be discharged through any suitably located flue or stack 5^a.

I can construct the outer wall and helices of my improved furnace of cement or cement-concrete, reinforced, if desired, and can therefore dispense with the arching of the hearth structure necessary in constructing of bricks or tiles an ordinary furnace of the horizontal hearth type, thereby preventing the loss of space due to such arch formation and being enabled to dispose the hearth convolutions as closely together as is consistent with the free play of the rabbles and rabble arms whereby the forward flow of
95 the material through the furnace is effected. The wall whereby the inner ends of the convolutions of the chambers 2^a and 3^a is closed against the escape of gases therefrom constitutes a cylindrical shaft 6 consisting, by preference, of an inner metallic cylinder provided with a covering or coating of cement or concrete of a thickness sufficient to protect it from the injurious effect of the heat and gases to which it
105 would otherwise be subjected. The cylindrical shaft 6 has a combined partial rotating and rising and falling movement imparted to it and the rabble arms 7 are secured to the shaft, the movement of the
110

latter being such that the rabble arms are caused to travel in a spiral course having a pitch corresponding with that of the helices 2 and 3, the rabbles, during their backward and upward movement, traveling through the material on the hearth and being so formed as to cause as little disturbance as possible of the material during such movement, while exercising a proper pushing or feeding effect upon the material during the forward and downward movement.

In order to support the central shaft 6, I provide, within the same, a fixed central structure consisting in the present instance of a series of vertical columns 8 suitably braced to give the necessary rigidity, this structure carrying, upon its outer periphery, a series of spiral tracks 9 which extend around or part way around the structure and serve for the support and guidance of wheels 10 mounted so as to rotate in suitable bearings in brackets secured to the inner face of the shaft 6, as shown in Fig. 1, whereby, as said shaft is rotated, it will, at the same time, rise or fall, depending upon the direction of rotation, the pitch of the tracks 9 being similar to that of the helices 2 and 3 so as to cause the rabbles to properly follow the course of the hearth 2 both in their descending and ascending movements.

Movements of rotation or partial rotation are imparted to the shaft 6 in any suitable manner, the means adopted in the present instance being a system of gearing as follows: To the inner face of the shaft 6 is secured spiral rack 11 which meshes with a toothed wheel 12 on a shaft 13 free to turn in suitable bearings carried by the fixed structure 8, this shaft having a bevel wheel 14 which meshes with a bevel pinion 15 on a vertical shaft 16, likewise mounted in suitable bearings on the structure 8 and carrying, at its upper end, a spur-wheel 17 which meshes with a spur pinion 18 on a vertical shaft 19, the latter being mounted in suitable bearings on the structure 8 and on a transverse beam 20 at the top of the furnace and being geared by bevel wheels 21 and 22 to a horizontal shaft 23 which constitutes the power shaft and is furnished with fast and loose pulleys, belt shippers, or other equivalent mechanism whereby power may be supplied to turn the shaft 6 in either direction, so that during part of the time the shaft 6 may be turned in one direction to cause descending movement of said shaft and of the rabbles carried thereby and during the remainder of the time said shaft may be turned in the opposite direction so as to cause ascending movement of the shaft and its rabbles.

When a muffle furnace is not desired, both of the chambers 2^a and 3^a may be used for

the reception and travel of the ore or other material to be treated, the conveyers 4 being duplicated accordingly.

The rabbles carried by the rabble arms 7 may be variously constructed to serve their intended purpose of feeding the material forward on the hearth during the forward and downward movement of the rabbles and for plowing through said material without material disturbance of the same on the upward and backward movement, for instance, two sets of triangularly shaped rabbles 25 disposed one set in advance of the other may be employed, as shown in Fig. 3, the flat faces of these rabbles being at the front so that in moving forward the rabbles will push the material ahead of them but in moving backward will present their beveled faces to the material and will dispose the same in ridges to be acted upon by the flat faces of the rabbles on their next forward movement, or a single set of rabbles 26 of triangular cross section may be employed which are susceptible of being moved longitudinally upon the rabble arm whereby, when the rabble reaches or is approaching the limit of its back movement, shifting of the rabbles will cause the flat forward faces of the same to act upon the ridges of material laterally displaced by the beveled rear faces of the rabbles in their back movement, as shown, respectively, in Figs. 4 and 5, or each rabble may be composed of blades hinged at their rear ends, as shown at 27 in Figs. 6 and 7 whereby, on the backward movement, the blades will lie closely together, as shown in Fig. 6, but on resuming their forward movement they will be caused to spread apart, as shown in Fig. 7, or flat rabble blades mounted upon vertical pivots may be employed, as shown at 28 in Figs. 8 and 9, the flat edge of the blade being presented to the material on the backward movement of the rabble, as shown in Fig. 8, and a quarter turn being then imparted to the blade so that it will present its broad face to the material on the forward movement, as shown in Fig. 9.

In the modified construction of my improved furnace shown in Fig. 10 the central shaft 6 is stationary and the helical hearths 2 and 3 project therefrom, the outer casing of the furnace carrying rabble arms and having the rotating and vertical reciprocating motion imparted to it.

In the modified type of furnace shown in Fig. 11 the helical hearth structure is carried by a rotating truck 30 having wheels 31 which run upon annular rails 32 carried by a suitable foundation structure. In this case both the central and outer shells of the furnace are stationary and are mounted upon suitable supports, the hearth structure rotating between these stationary shells. In this furnace the rabble arms 7 are carried by vertically movable bars 33 which are fitted

to vertical slots in the inner and outer fixed shells of the furnace and are moved vertically by a suitable gearing so that as the hearth structure rotates each rabble arm will follow the pitch line of the chamber into which it projects, the hearth structure having first a movement of one or more turns in one direction and then a corresponding movement in the reverse direction and the rabble carrying bars 33 being raised or lowered to accord with the direction in which the hearth structure is rotating.

In a furnace of this type the products of combustion may be admitted to the muffle chamber 3^a from an annular flue underneath the rotating hearth structure, and the waste products of combustion may be carried off through a like annular flue above the roof member of said rotating hearth structure.

The rotating hearth structure may be composed of cement or concrete, being made in one piece, the hearths being supported by a central perforated wall or series of posts so as to provide communication between the inner and outer portions of the chamber, or the hearths may be formed in one piece with the inner or outer wall or shell of the furnace which will rotate with the hearths, the rabble arms being carried by the other wall

of the furnace or by sections thereof which will have vertical and reciprocating movements.

I do not, however, herein claim specifically the rotating hearth type of furnace, but—

I claim:

1. A metallurgical furnace having a plurality of helices constituting the hearths of a corresponding plurality of helical chambers.

2. A metallurgical furnace having a sustaining wall, and a plurality of helices projecting therefrom and constituting the hearths of a corresponding plurality of helical chambers.

3. A metallurgical furnace having an outer wall and a plurality of helices projecting inwardly therefrom, and constituting the hearths of a corresponding plurality of helical chambers.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

UTLEY WEDGE.

Witnesses:

KATE A. BEADLE,
HAMILTON D. TURNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."